

# 270V/100W DC/DC Converter with Integral EMI Filter

## ADVANCE INFORMATION

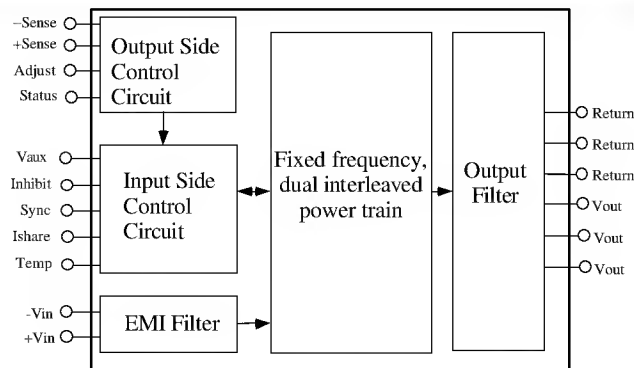
## ADDC27005SA

### FEATURES

270Vdc input, 5Vdc @ 20A, 100W output  
Integral EMI filter  
Low weight: 80 grams  
NAVMAT derated  
Many protection and system features

### APPLICATIONS

Commercial and Military Airborne Electronics  
Missile Electronics  
Space-Based Antennae and Vehicles  
Mobile/Portable Ground Equipment  
Distributed Power Architecture for Active Array Radar



ADDC27005SA FUNCTIONAL BLOCK DIAGRAM

### GENERAL DESCRIPTION

The ADDC27005SA hybrid military DC/DC converter with an integral EMI filter offers the highest power density of any military power converter with its features and in its power range available today. The converter with integral EMI filter is a fixed frequency, 1 MHz, square wave switching DC/DC power supply. It is not a variable frequency resonant converter. In addition to many protection features, this converter has system level features which allows it to be used as a component in larger systems as well as a stand-alone power supply. The unit is designed for high reliability and high performance applications where saving space and/or weight are critical.

The ADDC27005SA is available in 3 screening grades; all grades use a hermetically sealed, molybdenum based hybrid package. For MIL-STD-883 devices, contact factory for availability.

### PRODUCT HIGHLIGHTS

- 1) 60W/cubic inch power density with an integral EMI filter designed to meet all applicable requirements in MIL-STD-461D when installed in a typical system setup.
- 2) Light weight: 80 grams
- 3) Operational and survivable over a wide range of input conditions: 160-400Vdc; survives low line and high. Contact factory for availability of units with modified input voltage range.
- 4) High reliability; NAVMAT derated with minor exceptions.
- 5) Protection features include:
  - output overvoltage protection
  - output short circuit current protection
  - thermal monitor/shutdown
  - input overvoltage shutdown
- 6) System level features include:
  - current sharing for parallel operation
  - logic level disable
  - output status signal
  - synchronization for multiple units
  - input referenced auxiliary voltage supply

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# SPECIFICATIONS

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

Inhibit.....450Vdc, -0.5Vdc  
 Sync.....8Vdc, -0.5Vdc  
 Ishare.....6Vdc, -0.5Vdc  
 Temp.....16Vdc, -0.3Vdc

Lead Soldering Temp (10 sec) .....+300°C  
 Storage Temperature .....-65°C to +150°C  
 Maximum Junction Temperature.....+150°C

**ADDC27005SA PRELIMINARY ELECTRICAL CHARACTERISTICS** ( $T_c=25^\circ\text{C}$ ,  $V_{in}=270\text{Vdc}$  unless otherwise noted; full temperature range is  $-55^\circ\text{C}$  to  $+90^\circ\text{C}$ ; all temperatures are case and are measured at the center of the package bottom.)

Parameter	Temp	Test Level	Conditions	ADDC27005S			
				Min	Typ	Max	Units
<b>INPUT CHARACTERISTICS</b>							
Steady State Operating Input Voltage Range	Full	I	Po=10W to 100W	200	270	350	Volts
Short Term Operating Input Voltage Range (per MIL-STD-704D)	Full	I	Po=10W to 80W	160		400	Volts
Input Voltage Shutdown	+25°C	I		400		tbd	Vdc
Disabled Input Current	+25°C	V			4		mA
<b>OUTPUT CHARACTERISTICS<sup>2,3</sup></b>							
Output Voltage (Vo)	+25°C	I	Po=10W to 100W, Vin=200 to 350Vdc	5.00	5.025	5.05	Vdc
	Full	I	Po=10W to 100W, Vin=200 to 350Vdc	4.90		5.10	Vdc
	Full	I	Po=10W to 80W, Vin=160 to 400Vdc	4.85		5.15	Vdc
Line Regulation	+25°C	V	Po=100W, Vin=200 to 350Vdc		5		mV
Load Regulation	+25°C	V	Vin=270Vdc, Po=10W to 100W		5		mV
Output Ripple/Noise	+25°C	I	Po=100W, 5 kHz - 20 MHz BW			50	mVp-p
Output Current (Io)	Full	I	Vo=5Vdc, Vin=200 to 350Vdc	2		20	A
Output Overvoltage Protection <sup>4</sup>	+25°C	I	Io=tbd			tbd	%Vnom
Output Current Limit	+25°C	V	Vo=90%Vout nom		150		%Io max
Output Short Circuit Current	+25°C	I	$\_m\Omega < R_{short\ circuit} < \_m\Omega$			tbd	A
<b>ISOLATION CHARACTERISTICS</b>							
Isolation Voltage	+25°C	I	Input to output or any pin to case at 500Vdc	100			MΩ
<b>DYNAMIC CHARACTERISTICS</b>							
Clock Frequency	Full	I		0.90		1.00	MHz
Soft Start Turn-On Time	+25°C	I	Io=20A			20	ms
<b>THERMAL CHARACTERISTICS</b>							
Efficiency	+25°C	I	Po=60W	78	79		%
	+25°C	I	Po=100W	77	78		%
Hottest Junction Temperature <sup>5</sup>	+90°C	V	Po=100W		110		°C
<b>MECHANICAL CHARACTERISTICS</b>							
Weight	Full	V			80		grams

## NOTES

<sup>1</sup> Absolute maximum ratings are limiting values, to be applied individually, and beyond which the serviceability of the circuit may be impaired. Functional operability under any of these conditions is not necessarily implied. Exposure of absolute maximum rating conditions for extended periods of time may affect device reliability.

<sup>2</sup> Measured at the remote sense points.

<sup>3</sup> Unit regulates output voltage to 5W load.

<sup>4</sup> Open remote sense connection.

<sup>5</sup> Refer to Thermal Characteristics section of the data sheet for more information.

## EXPLANATION OF TEST LEVELS

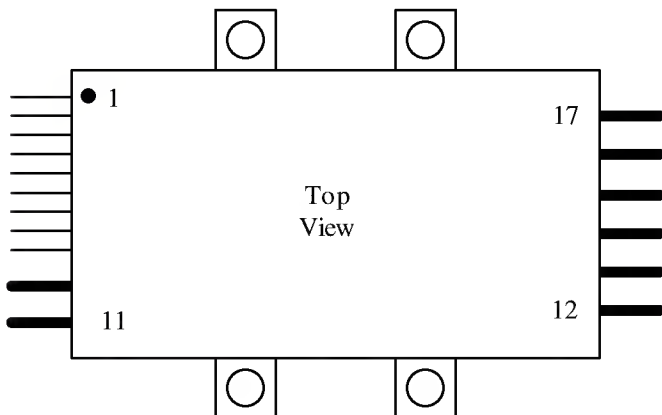
Test Level

- I - 100% Production Tested.
- II - 100% production tested at +25° C, and sample tested at specified temperatures.
- III - Sample Tested Only.
- IV - Parameter is guaranteed by design and characterization testing.
- V - Parameter is a typical value only.
- VI - All devices are 100% production tested at +25°C. 100% production tested at temperature extremes for military temperature devices; guaranteed by design and characterization testing for industrial devices.

## PIN DESCRIPTIONS

Pin No.	Name	Function
1	- SENSE	Feedback loop connection for remote sensing output voltage. Must always be connected to output return for proper operation.
2	+ SENSE	Feedback loop connection for remote sensing output voltage. Must always be connected to +Vout for proper operation.
3	ADJUST	Adjusts output voltage setpoint.
4	STATUS	Indicates output voltage is within $\pm 5\%$ of nominal. Active high referenced to - SENSE (pin 1).
5	Vaux	Low level dc auxiliary voltage supply referenced to input return (pin 10).
6	INHIBIT	Power supply disable. Active low and referenced to input return (pin 10).
7	SYNC	Clock synchronization input for multiple units; referenced to input return (pin 10).
8	Ishare	Current share pin which allows paralleled units to share current typically within $\pm 5\%$ at full load; referenced to input return (pin 10).
9	TEMP	Case temperature indicator and temperature shutdown override; referenced to input return (pin 10).
10	- Vin	Input return.
11	+ Vin	+270V nominal input bus.
12	+Vout	+5Vdc output.
13	+Vout	+5Vdc output.
14	+Vout	+5Vdc output.
15	RETURN	Output return.
16	RETURN	Output return.
17	RETURN	Output return.

## Pin Configuration



## Basic Operation

The ADDC27005SA design is a flyback topology with dual interleaved power trains operating 180° out of phase. Each power train switches at a fixed frequency of 500 kHz, resulting in a 1 MHz fixed switching frequency as seen at the input and output of the converter. In a flyback topology, energy is stored in the inductor during one half portion of the switching cycle and is then transferred to the output filter during the next half portion. With two interleaved power trains, energy is transferred to the output filter during both halves of the switching cycle, resulting in smaller filters to meet the required ripple.

A five pole differential input EMI filter, along with a common-mode EMI capacitor and careful attention to layout parasitics, is designed to meet all applicable requirements in MIL-STD-461D when installed in a typical system setup.

The design uses current mode control and employs a high performance opto-isolator to maintain isolation between input and output. The converter is designed to give nearly a constant output current as the output voltage drops from  $V_{nom}$  to  $V_{shckt}$  during a short circuit condition. It does not let the current fold back below the maximum rated output current. The overvoltage protection circuitry protects the load against a break in the remote sense leads. Remote sense connections, which can be made at the load, can adjust for voltage drops of as much as 0.25Vdc between the converter and the load, thereby maintaining an accurate voltage level at the load.

An internal temperature sensor shuts down the unit and prevents it from becoming too hot if the heat removal system fails. The temperature sensed is the case temperature and is factory set to trip at a nominal case temperature of 115°C. The shut down temperature setting can be raised externally or disabled by the user.

Each unit has an inhibit pin which can be used to turn off the converter. This feature can be used to sequence the turn-on of multiple converters and to reduce input power draw during extended time in a no load condition.

A sync pin, referenced to the input return line (pin 10), is available to synchronize multiple units to one switching frequency. This feature is particularly useful in eliminating beat frequencies, which may cause increased output ripple on paralleled units. A current share pin (Ishare) is available which permits paralleled units to share current typically within  $\pm 5\%$  at full load.

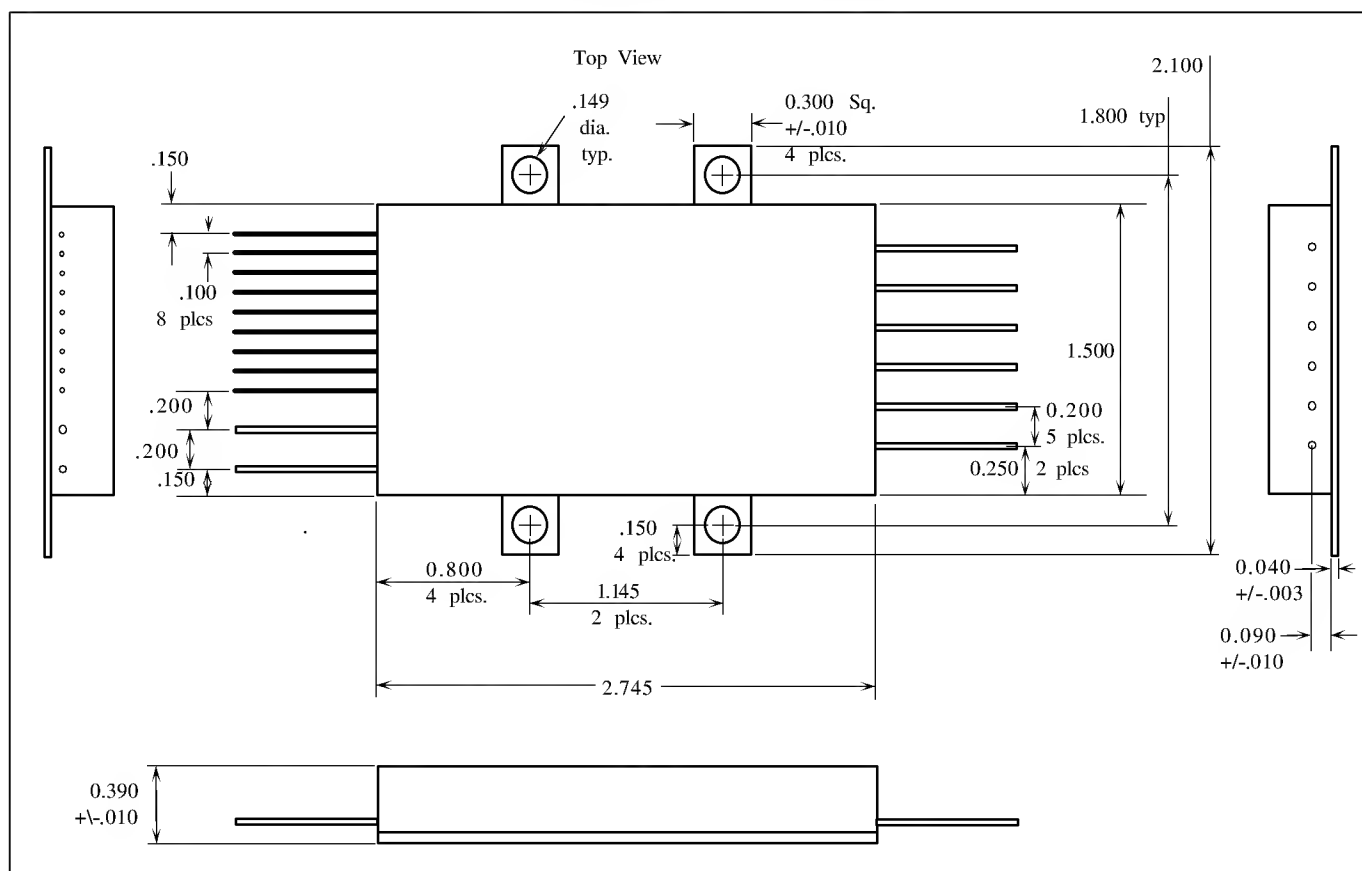
An auxiliary, low level dc bias voltage referenced to input return is provided for miscellaneous system use.

### Screening Levels for ADDC27005S

Screening Steps	Industrial (KV)	Ruggedized Industrial (TV)	MIL-STD-883B/SMD (TV/883B)
Pre-cap visual	100%	MIL-STD-883, TM2017	compliant to MIL-PRF-38534
Temp cycle	N/A	N/A	
Constant acceleration	N/A	N/A	
Fine leak	guaranteed to meet MIL-STD-883, TM1014	guaranteed to meet MIL-STD-883, TM1014	
Gross leak	guaranteed to meet MIL-STD-883, TM1014	guaranteed to meet MIL-STD-883, TM1014	
Burn-in	N/A	MIL-STD-883, TM1015, 96 hrs at 115°C case	
Final electrical test	at 25°C, per spec. table	at 25°C, per spec. table	

### Nominal Case Dimensions In Inches

All tolerances  $\pm 0.005$  unless otherwise specified



#### Notes

- The final product weight is 85 grams maximum.
- The package base material is made of molybdenum and is nominally 40 mils thick. The "runout" is less than 2 mils per inch.
- The high current pins are 40 mil diameter, are made of 99.8% copper, and are plated with gold over nickel.
- The signal carrying pins are 18 mil diameter, are made of Kovar, and are plated with gold over nickel.
- All pins are a minimum length of .740 inches when the product is shipped. The pins are typically bent up or down and cut shorter for proper connection into the user's system.
- All pin-to-sidewall spacings are guaranteed for a minimum of 500Vdc breakdown at standard air pressure.